Carlsbad Environmental Monitoring & Research Center

History, Mission, and Status Report

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New Mexico State University

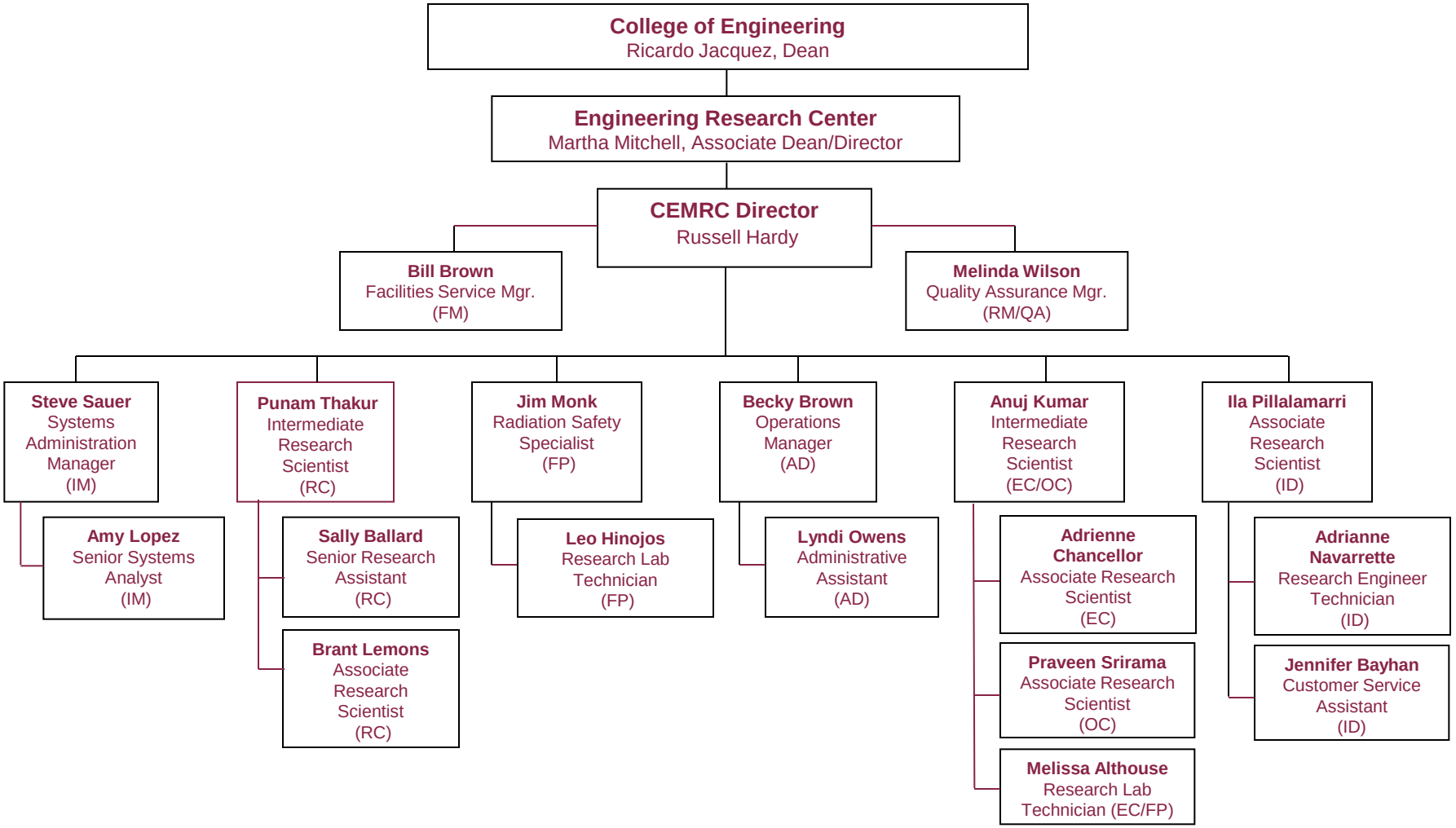
CEMRC History and Mission

- The CEMRC was created in 1991, through a grant from the U.S. DOE, as a division of the Waste-Management Education & Research Consortium (WERC).
  - WERC is a subunit of the College of Engineering (COE) at New Mexico State University in Las Cruces.
  - CEMRC now reports to the Engineering Research Office at COE, NMSU.

- Goals of CEMRC
  - Establish a permanent center of excellence to anticipate and respond to emerging health and environmental needs.
  - Develop and implement an independent health and environmental monitoring program in the vicinity of the DOE Waste Isolation Pilot Plant (WIPP) and make results easily accessible to all interested parties.

- Current CEMRC facility was constructed in 1996 and includes 26,000 ft^2 devoted to environmental monitoring associated with the WIPP.

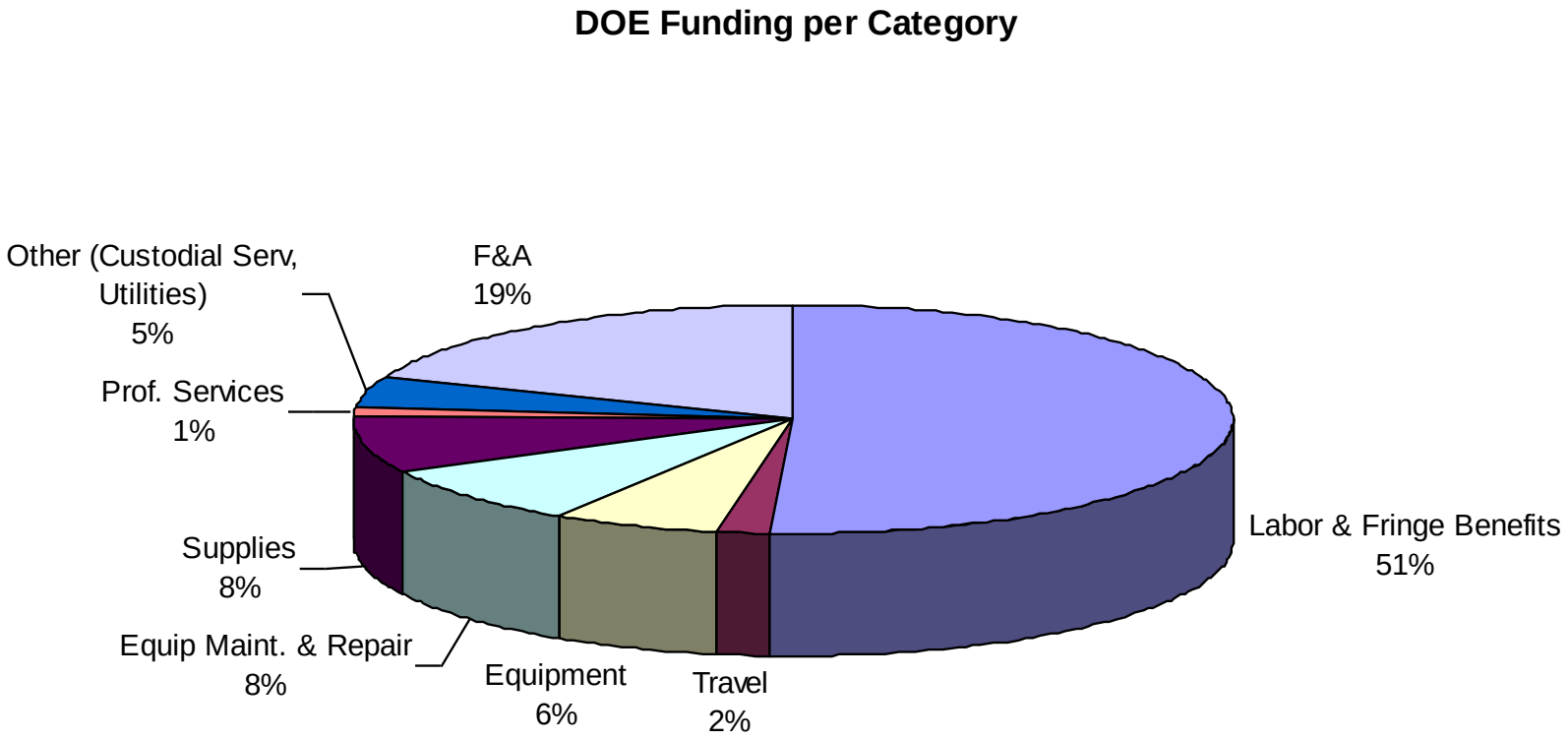
Carlsbad Environmental Monitoring & Research Center
Organizational Chart



CEMRC Finances

- In addition to the financial assistance grant contract with DOE/CBFO, CEMRC has contracts in place with LANL, WTS (WBC and VOC), WCS, and WSMS.
  - The DOE/CBFO funding accounts for approx. 70% of all CEMRC funds.
- Low Background Radiation Experiment (LBRE) project accounts for approx. 7.2% of the total DOE/CBFO funding.
  - The remaining 92.8% is devoted to WIPP-EM related tasks.

CEMRC Finances (Cont.)



Field Programs (FP)

- Daily (M-F) FP technicians collect FAS filters from station A for preparation and analysis. Station B filters are collected weekly (Wednesdays).
  - Desiccated, gravimetric analysis, transferred to the appropriate department for further testing or preparation.
- Every MWF, FP technicians check Hi-Vol filter flow rates and replace filters as necessary.
  - Loaded filters are prepared and transferred for further analysis.
- Annually, FP technicians collect drinking water samples and bi-annually they collect surface water, soil, and sediment samples for preparation and analysis.
  - FP has collected more than 1,000 samples since the beginning of the fiscal period (Oct. 1, 2011).

Sampling Schedule for FP

Year	2011	2012	2013	2014	2015
1st Quarter	Aerosol	Aerosol	Aerosol & Drinking Water	Aerosol	Aerosol, Surface Water, & Sediment
2nd Quarter	Aerosol	Aerosol, Surface Water & Sediment	Aerosol	Aerosol	Aerosol & Drinking Water
3rd Quarter	Aerosol & Drinking Water	Aerosol & Drinking Water	Aerosol, Surface Water & Sediment	Aerosol & Drinking Water	Aerosol
4th Quarter	Aerosol	Aerosol & Soil	Aerosol	Aerosol & Soil	Aerosol

Aerosol includes FAS (Station A & B), Glass Fiber Hi-Vol, and Whatman 41 Hi-Vol

Environmental Chemistry (EC)

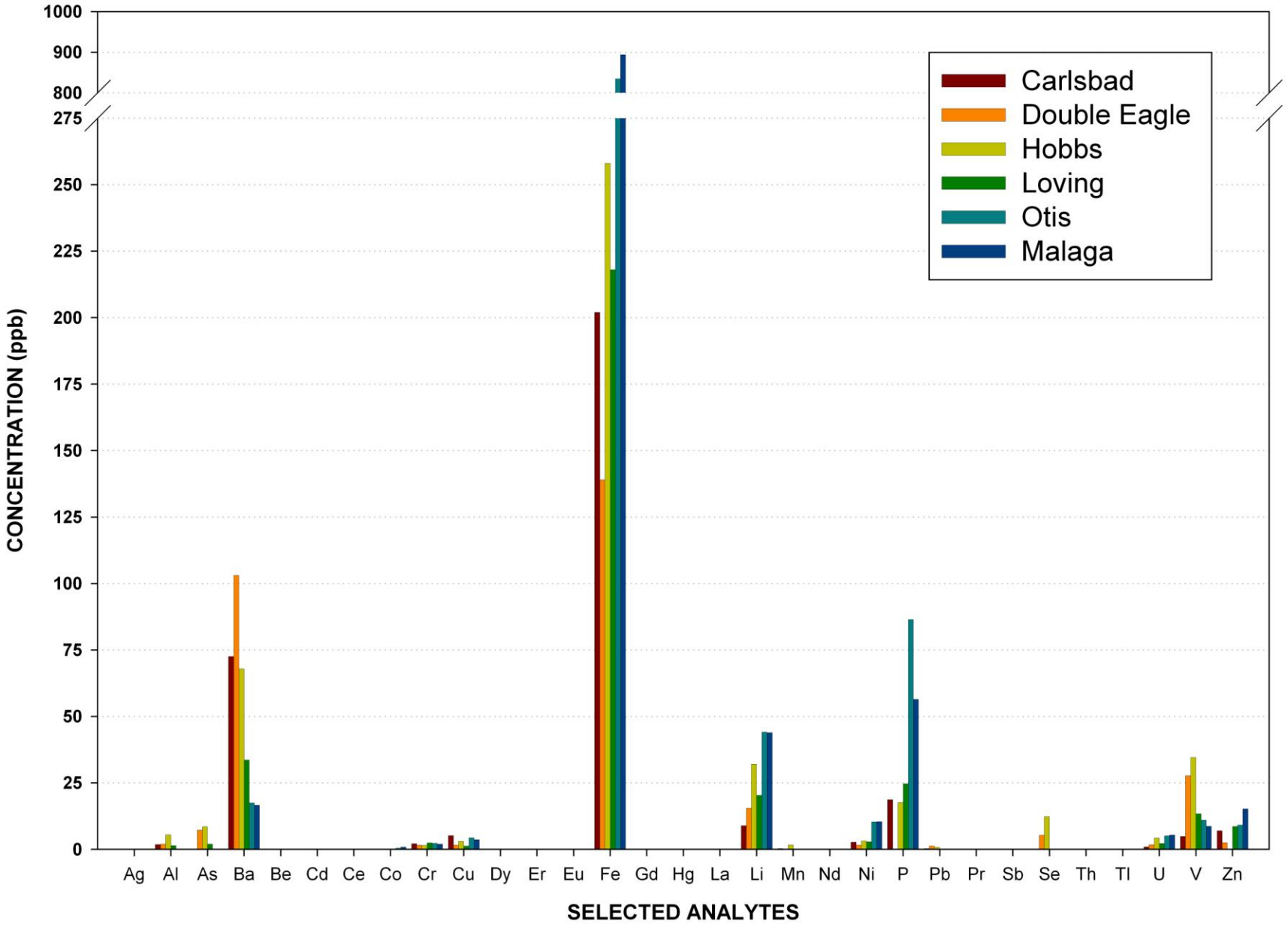
- The EC Group focuses on the determination of low levels of a variety of trace elements in environmental and other media.
  - The EC group has developed procedures for determining trace elements and heavy metals in air and water samples using the ICP-MS.
    - Data are collected on 37 different elements, with particular focus on Al, Cd, Mg, Pb, Th, and U.
  - Analyses of water samples for the presence of anions is performed using the IC.
    - Key anions analyzed include: Chloride, Fluoride, Bromide, Nitrate, Nitrite, Phosphate, and Sulfate.
  - Equipment utilized by the EC include an Inductively Coupled Plasma-Mass Spectrometry (ICP-MS), an Ion Chromatograph (IC), microwave digestion units, acid purification system, electronic balances, and standard lab equipment.

EC Media Analysis

- FAS Filters
  - FAS filter samples are digested individually in weekly batches.
    - Between 5-15 filters per weekly batch (approx. 450 filters per year) are consolidated into 48-52 weekly composite samples.
      - These weekly composites are analyzed for more than 30 elements based on EPA method 200.8.
      - Although there are seasonal variations in the elemental data from aerosol filters collected at Station A, there are no marked differences between the baseline (pre-operational) samples and the post-operational samples.

- Drinking Water
  - Drinking water samples are collected annually from local water sources including: Sheepsdraw, Loving, Otis, Malaga, Hobbs, and Double Eagle.
    - Elemental data show small concentrations and little variation between years for each source.
    - All concentrations of potentially toxic metals are well below RCRA limits.

Concentrations of Selected Metals in Drinking Water Sources Around Eddy County for 2011



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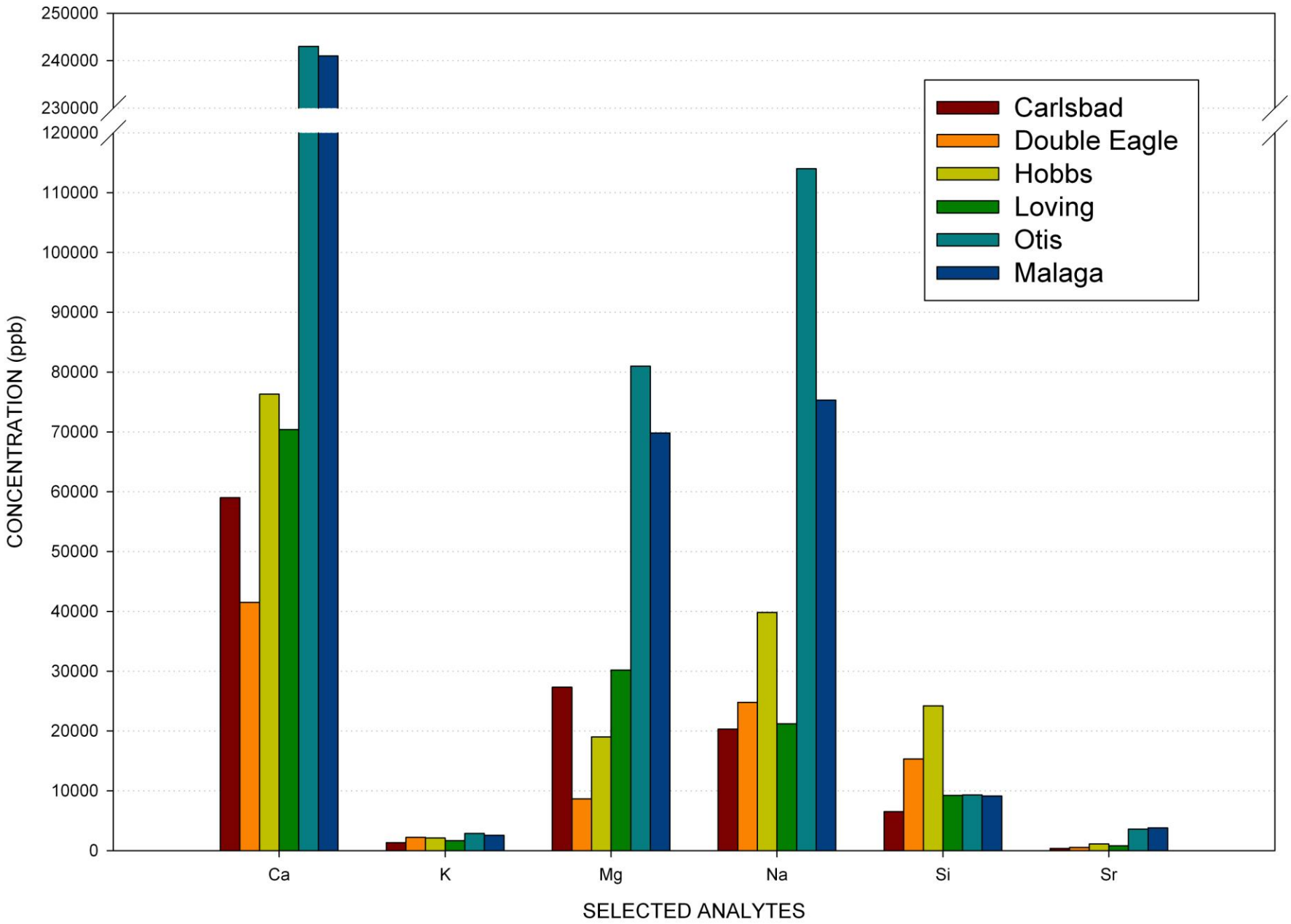
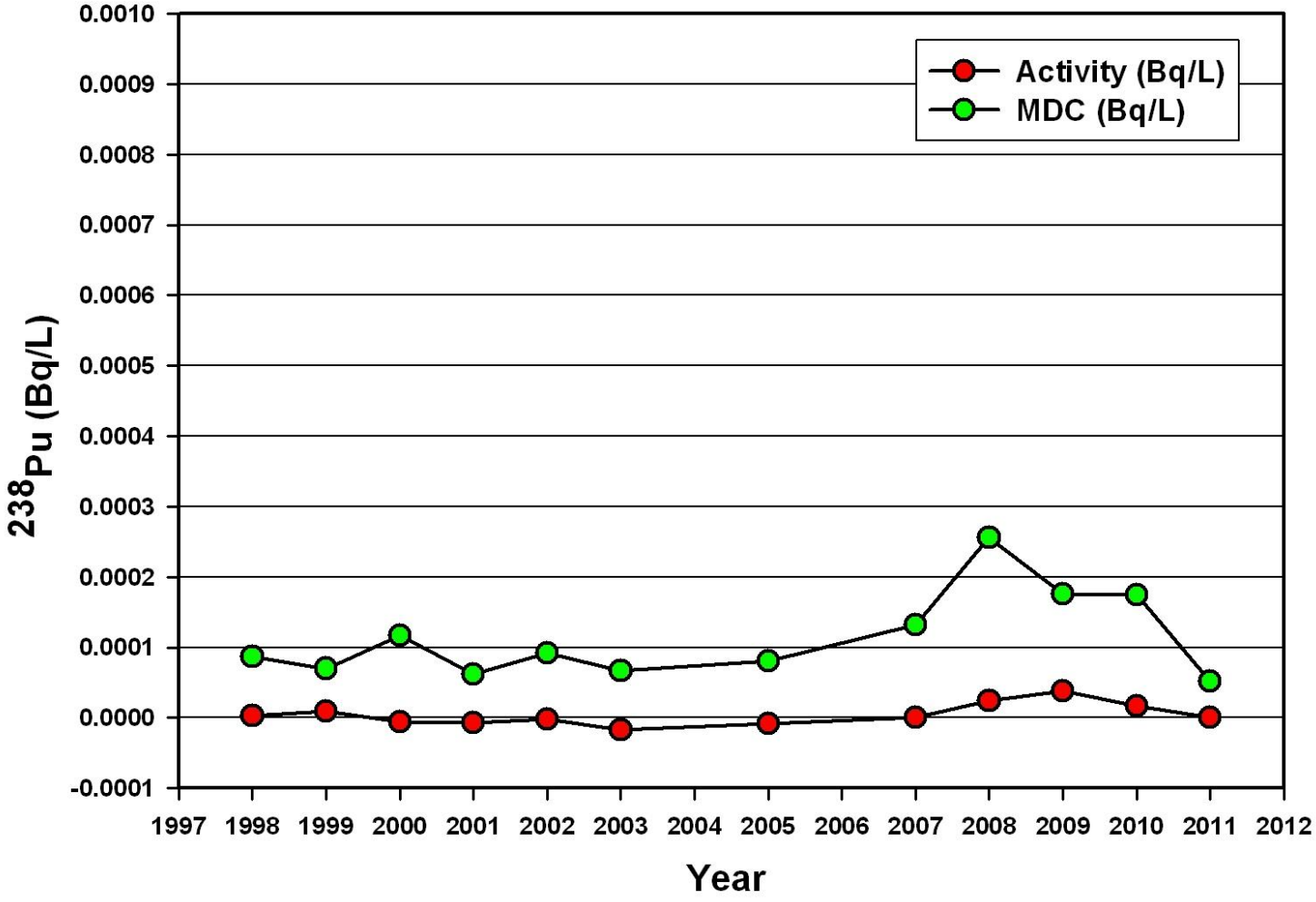
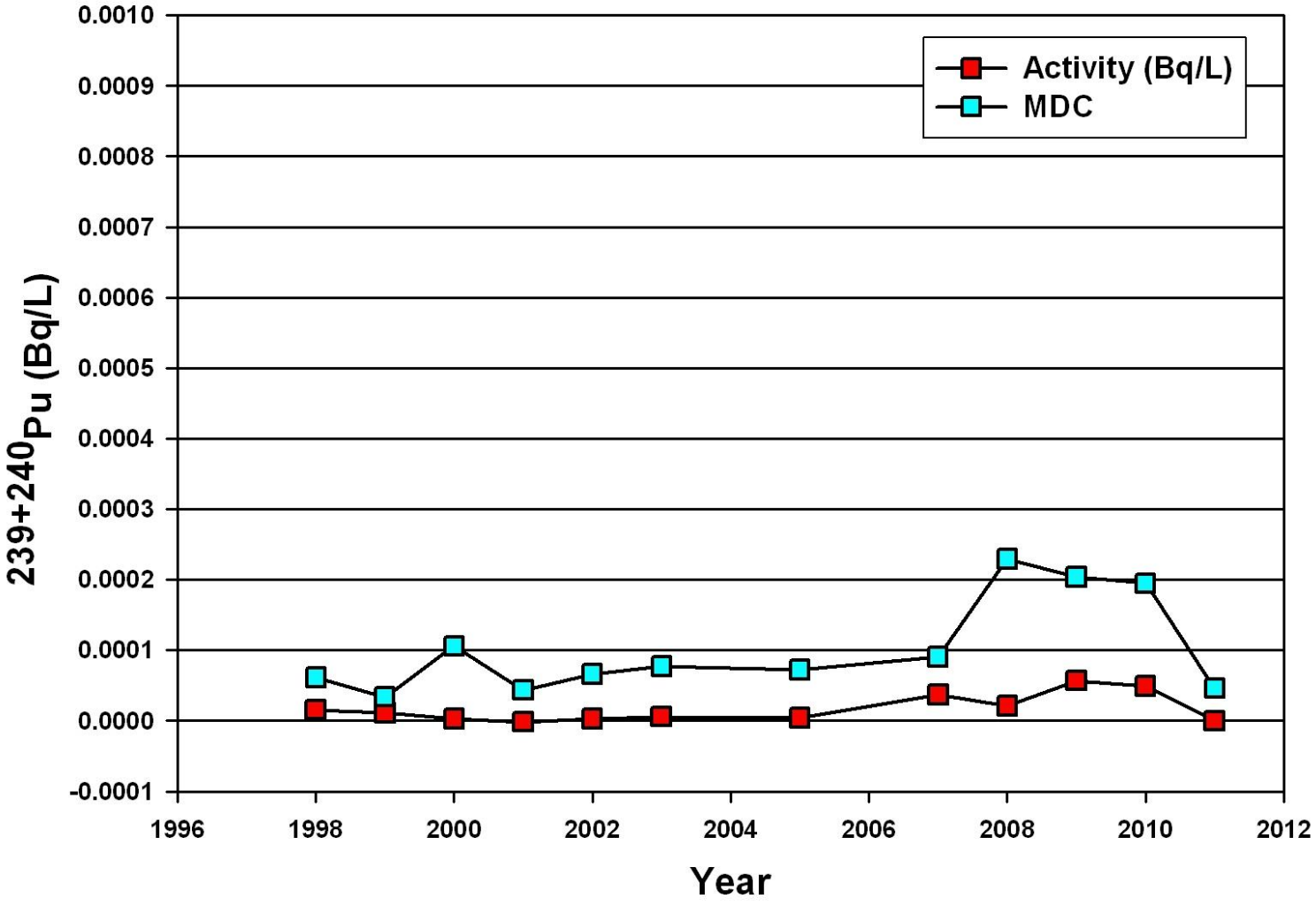


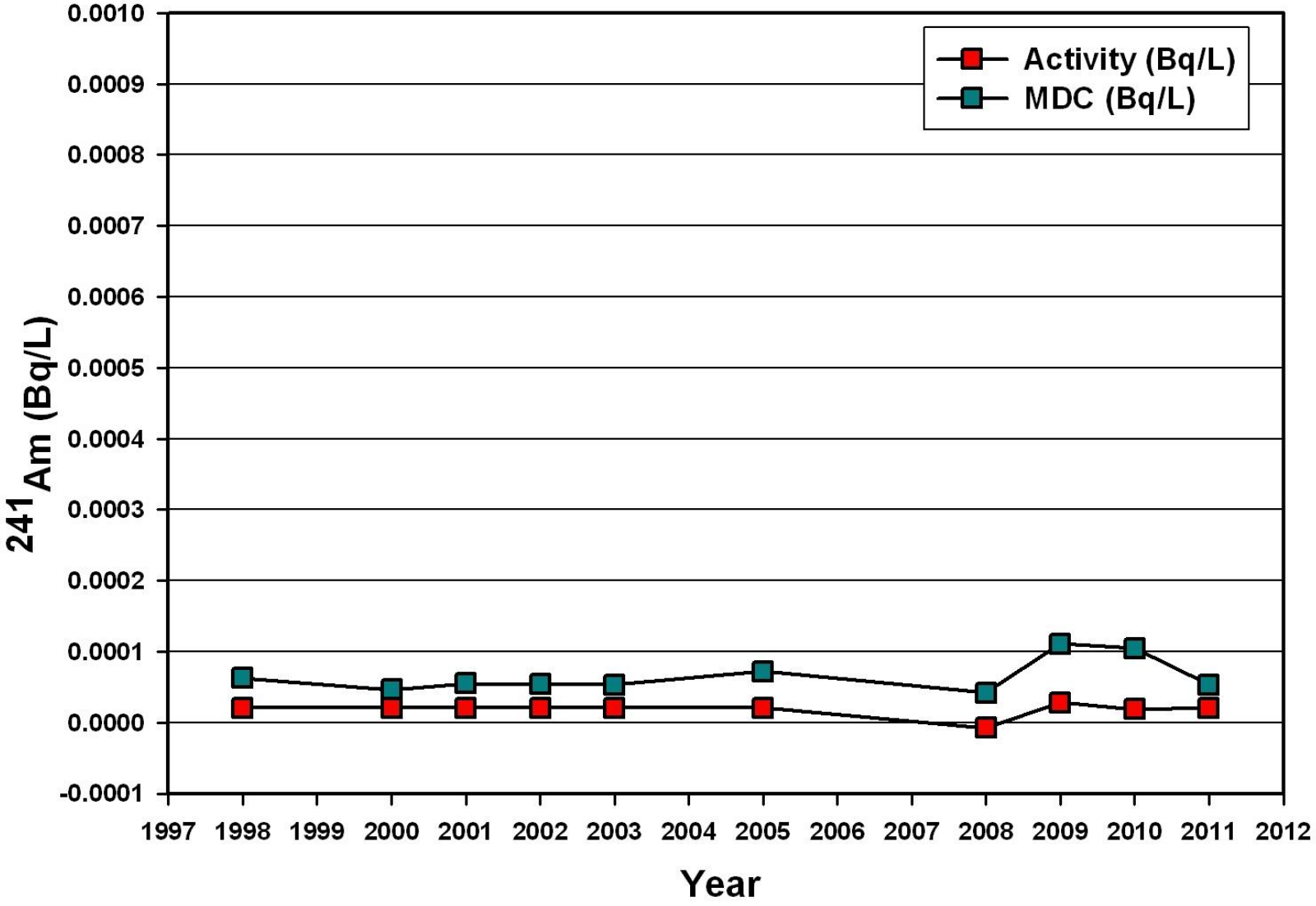
Carlsbad (PU^{238}) Concentration in DW



Carlsbad $PU^{239/240}$ Concentration in DW



Carlsbad Am^{241} Concentration in DW



Internal Dosimetry (ID)

- CEMRC utilizes a four-detector array for lung counting (low-lung 7-250keV and hi-lung 50keV-2MeV) and an eight-detector array for whole body counting.
  - This arrangement allows CEMRC to detect low activities with high sensitivity.
    - The CEMRC ID group maintains DOE-LAP accreditation and is audited by WTS annually.
  - Additionally, CEMRC owns a mobile WBC lab that can be utilized at remote locations or that can be mobilized in the event of a catastrophic nuclear-related event.

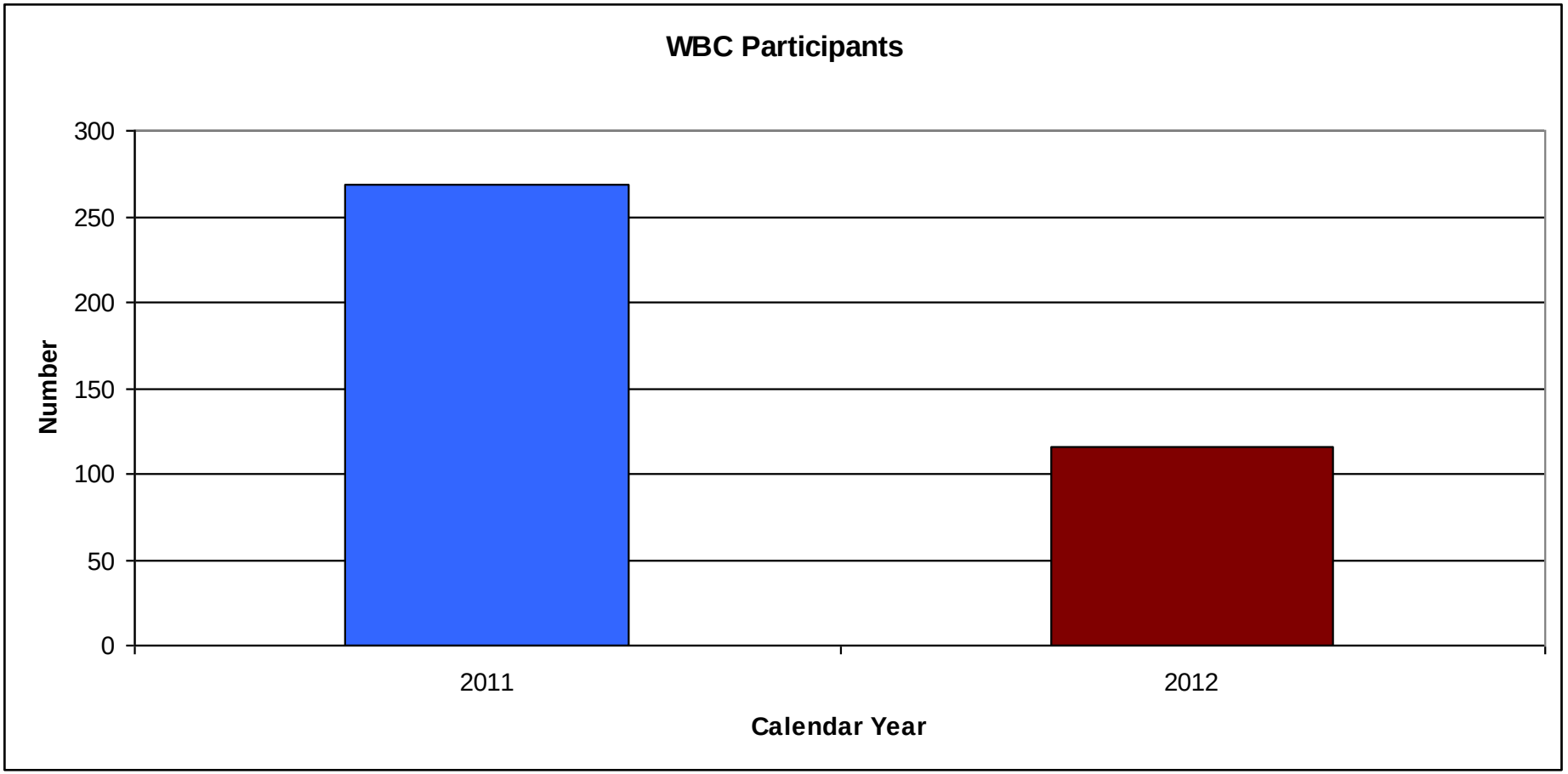
ID Detection Limits (Lung)

Radionuclide	Energy keV	CWT = 1.6 MDA (nCi)	CWT = 2.22 MDA (nCi)	CWT = 3.01 MDA (nCi)	CWT = 3.33 MDA (nCi)	CWT = 4.18 MDA (nCi)	CWT = 5.10 MDA (nCi)	CWT = 6.0 MDA (nCi)
AM-241	59.50	0.17	0.22	0.30	0.34	0.46	0.64	0.89
CE-144	133.50	0.49	0.57	0.72	0.79	1.02	1.34	1.76
CF-252	19.20	19.09	34.70	84.51	121.18	315.90	891.15	2454.73
CM-244	18.10	17.16	35.01	93.70	139.72	402.23	1264.15	3875.50
EU-155	105.30	0.26	0.33	0.43	0.48	0.63	0.85	1.15
NP-237	86.50	0.45	0.59	0.78	0.87	1.16	1.60	2.19
Pu-238 (Pu-ISOTP)	17.10	17.52	41.27	121.80	190.25	611.99	2179.54	7529.31
Pu-239 (Pu-ISOTP)	17.10	43.60	102.69	303.04	473.35	1522.65	5422.77	18733.21
Pu-240 (Pu-ISOTP)	17.10	17.13	40.34	119.05	185.96	598.18	2130.37	7359.48
Pu-242 (Pu-ISOTP)	17.10	20.66	48.67	143.62	224.33	721.62	2569.98	8878.10
Ra-226 (U-235/RA)	186.10	1.81	1.94	2.40	2.61	3.26	4.16	5.28
Th-232 Via Pb-212 (Th-I (Pb))	238.60	0.15	0.17	0.21	0.23	0.29	0.37	0.48
Th-232 (TH-I(T2))	59.00	31.88	41.97	55.90	62.88	85.81	120.21	166.78
Th-232 via Th-228 (TH-I (T8))	84.30	4.43	5.87	7.67	8.61	11.57	15.92	21.77
U-233	440.30	0.65	0.76	0.92	0.99	1.23	1.53	1.91
U-235 (U-235/RA)	185.70	0.11	0.12	0.15	0.16	0.20	0.26	0.33
Nat U via Th-234 (U-ISOTP)	63.30	1.49	1.99	2.65	2.97	4.04	5.64	7.80

ID Detection Limits (Whole Body)

Nuclide	Energy (keV)	MDA (nCi)	Nuclide	Energy (keV)	MDA (nCi)
Ba-133	356	0.80	Fe-59	1099	0.68
Ba-140	537	1.55	I-131	365	0.49
Ce-141	145	1.70	I-133	530	0.43
Co-58	811	0.37	Ir-192	317	0.56
Co-60	1333	0.36	Mn-54	835	0.46
Cr-51	320	4.61	Ru-103	497	0.41
Cs-134	604	0.36	Ru-106	622	3.36
Cs-137	662	0.43	Sb-125	428	1.38
Eu-152	344	1.66	Th-232 via Ac-228	911	1.29
Eu-154	1275	0.97	Y-88	898	0.38
Eu-155	105	3.84	Zn-65	1116	1.13
			Zr-95	757	0.60

ID Continued



Organic Chemistry (OC)

- The OC group provides detailed analysis of Volatile Organic Compounds (VOCs), Hydrogen, and Methane (HM) present in the WIPP underground air.
  - The WIPP Hazardous Waste Facility Permit mandates the monitoring of (9) VOCs in the ambient air underground at WIPP.
    - Ambient air samples are collected in six liter Summa canisters which are delivered weekly to CEMRC for analysis.
      - CEMRC began VOC analysis in 2004 and added analysis of HM in 2007.
    - The latest proficiency testing period (Nov 2011) for the OC lab resulted in the passing of all (9) target VOCs and successful identification of all other non-target analytes.

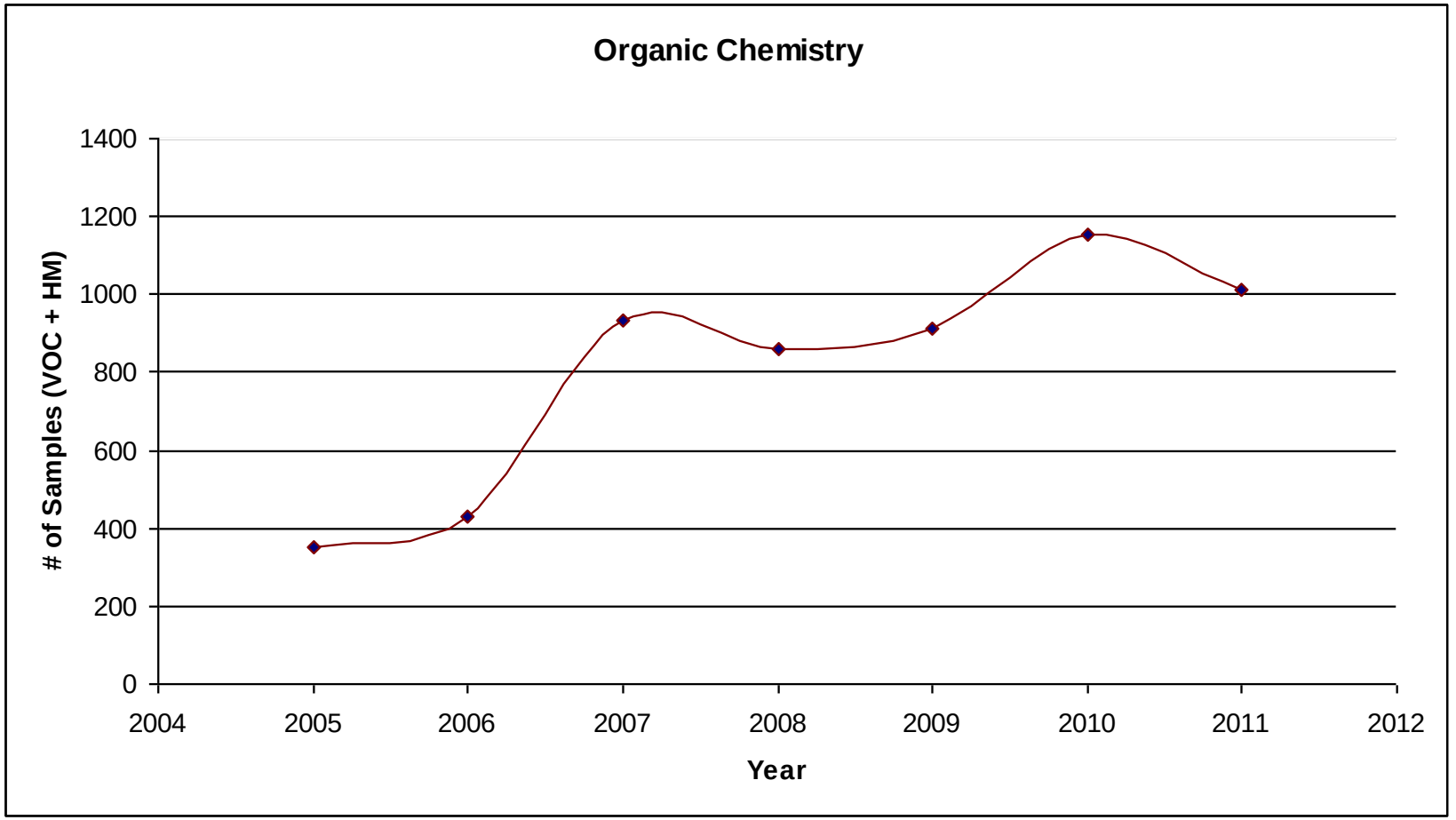
Compound	Reporting Limit (ppmv)
Hydrogen	150
Methane	150

VOCs of Interest for WIPP Monitoring Program

Compound	Repository Sample Reporting Limit (ppbv)	Closed Room Sample Reporting Limit (ppbv)
1,1-Dichloroethene	5	500
Carbon tetrachloride	2	500
Methylene chloride	5	500
Chloroform	2	500
1,1,2,2-Tetrachloroethane	2	500
1,1,1-Trichloroethane	5	500
Chlorobenzene	2	500
1,2-Dichloroethane	2	500
Toluene	5	500
Benzene*	2	500
Trichloroethylene*	2	500
Tetrachloroethylene*	5	500
Chloromethane*	2	500
trans-1,2-Dichloroethylene*	2	500
1,2,4-Trimethylbenzene*	2	500
p,m-Xylene*	5	500
Trichloromonofluoromethane*	2	500

*Note: * Additional Requested Compounds*

Samples Analyzed by OC Group since 2004



Turnaround time for routine samples is 30 days, for rush samples is 7 days

OC Key Accomplishments

- The VOC/HM analysis and WBC programs are audited annually by the WTS QA group.
  - The most recent audit (June 2012) concluded that “CEMRC is capable and has the quality controls in place to adequately perform the requested scope of work”.
- The OC Lab assisted Mosaic Potash with gas sample analysis in March 2012 following a significant collapse of the back in a portion of one of their mines.

Radiochemistry (RC)

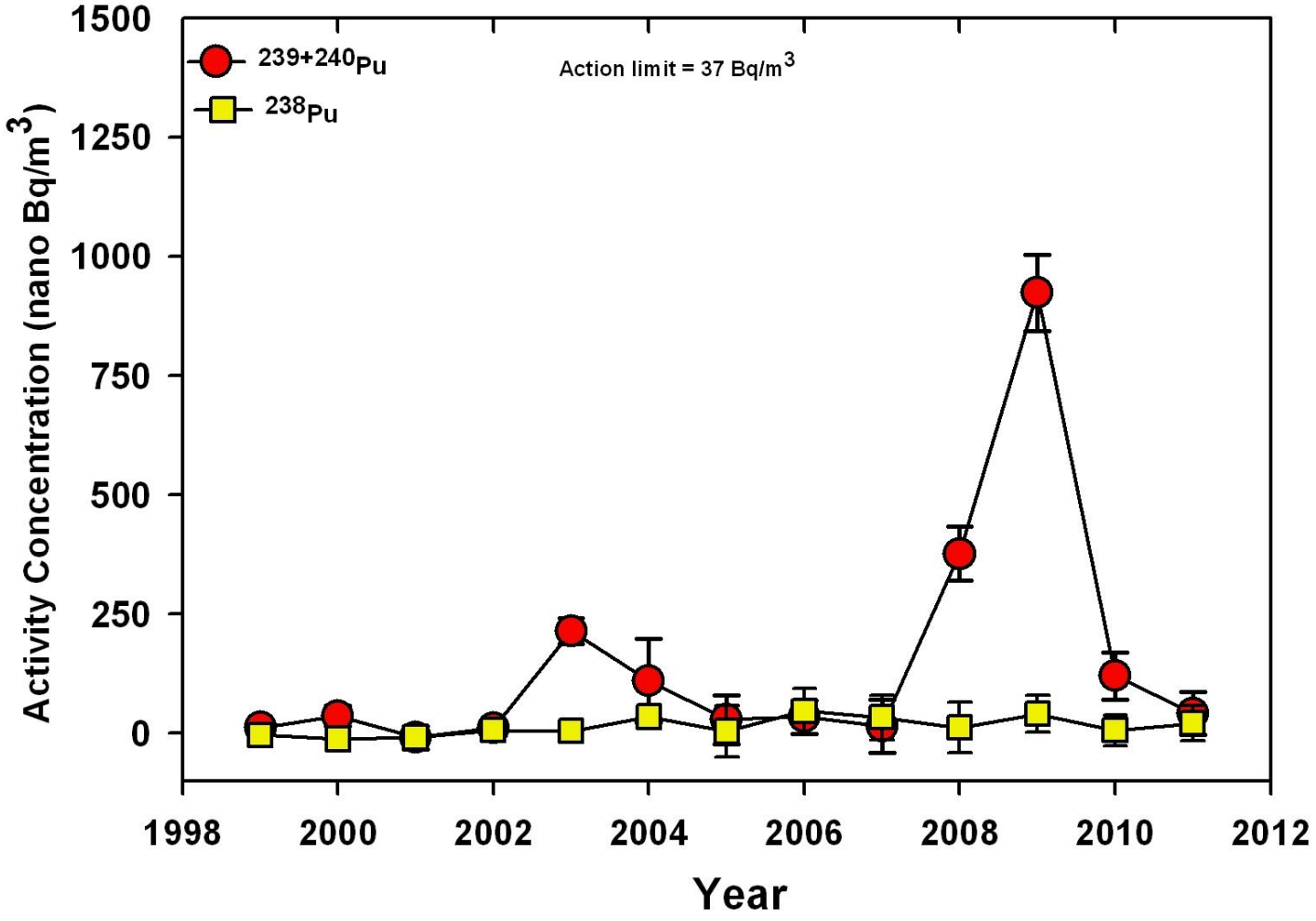
- The CEMRC RC program focuses on the monitoring of selected radionuclides in various environmental media collected in the vicinity of the WIPP.
  - Results from this program are accessible to the public and are used in evaluating the impact of WIPP, if any, on the local environment.
    - The goal of the program is to detect radionuclides as quickly as possible in the event of an accidental release within the site or the repository.
    - Air, soil, sediments, surface water, and drinking water are the primary media sampled and analyzed.
      - RC group uses four (4) high-purity germanium (HPGe) gamma detectors, an alpha spectrometer with 48 vacuum chambers, a liquid scintillation counter, and a Protean ultra-low level counter to perform these analyses.

RC Reported Activity

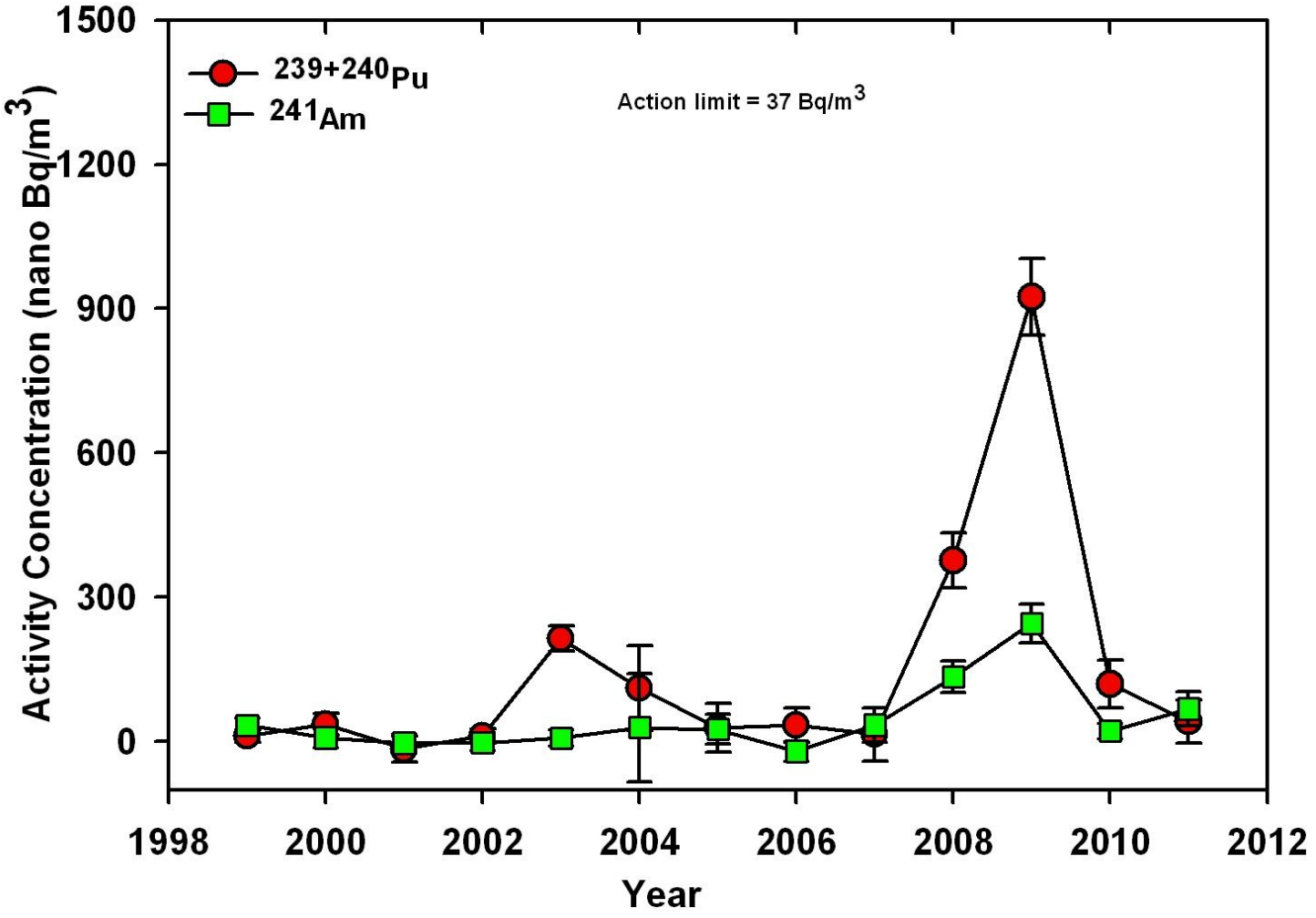
- In the years since WIPP has been operational, CEMRC has reported small detections of plutonium from composite samples of station A filters in the years 2003, 2008, 2009, and 2010.
    - The level of detection have all been orders of magnitude below compliance or action levels and are likely due to seasonal dispersion of dust containing fallout from global weapons testing or the Gnome site.
  - It is important to note that during the 13 years that WIPP has been operational, CEMRC has detected only four (4) composite samples (out of more than 675 tested) that were above MDC.
- CEMRC saw no detectable concentrations of plutonium (Pu) or americium (Am) in any of the 2011 samples.

- ***To date, there is no evidence of any release from WIPP contributing to radionuclide concentrations in the environment.***

Station A (Pu) Concentrations



Station A (Pu + Am) Concentrations



RC Reported Activity (Cont.)

- Beginning in March 2011, CEMRC has seen traces of I^{131}, Te^{132}, Cs^{134} and Cs^{137} as a result of an airborne release at the Fukushima-Daiichi nuclear power plant in Japan.
  - Cesium and iodine were detected from March 14 through May 2, 2011
- ***The detection of Fukushima radionuclides illustrate the sensitivity of CEMRC's analysis and help assure local citizens that no amount of radionuclides can go undetected by CEMRC's monitoring efforts.***

RC Quality Assurance

- In addition to internal audits, the RC group participates annually in two national proficiency reviews.
  - DOE Mixed Analyte Performance Evaluation Program (MAPEP)
  - National Institute of Standards and Technology (NIST) – National Radiochemistry Intercomparison Program (NRIP).

CEMRC Short-Term Plans

- INL Head Space Gas project
- Application to NMED for radiation license upgrade
  - Facility decommissioning plan update currently underway.
- Long-Term Mercury Disposal project
- Develop methods for the rapid detection of $Sr^{89/90}$ in EM samples.
- Continue to refine existing RC separation procedures to increase sample throughput and decrease sample preparation time.
- Approach Homeland Security about mobile WBC capabilities
- Continue to promote Lie Down & Be Counted program to area residents

Long-Term Plans

- Approach oil & gas producers in area regarding environmental monitoring capabilities
  - Sampling/analysis of air, water, & soil for VOCs, heavy metals, and/or NORM/TENORM.
    - 90 active rigs drilling in NM, 85% of those in Lea & Eddy County
- Continue to strengthen and refine EM-related activities in support of new nuclear-related opportunities in area.
  - In the event additional nuclear-related opportunities arise
    - Interim storage facility, International Isotopes facility, possible high-level waste repository,…
    - Develop analytical method for I^{129}, and develop rapid methods for radiochemical analysis of food and water.
- Expand educational and research outreach activities at CEMRC
  - Symposium for university partners to collaborate with CEMRC, Sandia, LANL, NWP, and DOE and discuss opportunities.
  - NSF proposal for interdisciplinary research workshop.

Short-Term Needs

- Equipment
  - Replace ICP-MS ($175K)
  - New Mercury analyzer ($43K)
  - Replace Field program truck ($35K)
  - New Lynx detectors for WBC ($66K)
  - Replace radiation safety low background counter ($50K)
- Facility-related repairs
  - Replace hoods for RC group and WSMS labs (9) – ($225K)
  - Replace ventilation stacks for hoods ($75-100K)
  - Upgrade electrical service to center ($150K)
  - Replace roof over administration and library areas (Need Est.)
  - Test and balance of ventilation system center-wide ($40K)
- Staffing
  - Need additional staffing (radiochemist) for RC group ($100K)

Long-Term Needs

- Potential for additional staffing for FP/EC/OC depending on additional contracts and/or new nuclear-related opportunities
- New lab wing for higher-level activity and/or research capabilities to support possible new nuclear-related opportunities
- Replacement of remaining vent hoods, carpet in facility, staff computers and servers, aging equipment,… as noted in 5-year needs list included in packet

Questions?

- Are there any questions?